the former contain a large proportion of magnesic chloride, whilst the latter are practically free from this objectionable impurity.

In addition to the Alsatian and German deposits, a number of other deposits are known. There are deposits in Galicia, which have been worked in a small way for some years, as also at Erythrea, in Italy, and the existence of a number of others that have not yet been worked has been recorded. It appears that the recently discovered deposits in Catalonia, Spain, are likely to prove quite important. In several parts of the world lakes rich in potash salts have been worked —*e.g.* in Tunis, in Chile, and in the United States. Those in the last-named country occur in Central Nebraska, and produced salts carrying 40,000 tons of K_2O in 1918, the producing capacity being estimated at 50,000 tons, or about one-half of the total producing capacity of the entire United States.

In this country the only practically available source of supply is the flue-dust from blast-furnaces. It has long been known that this dust contains potash, but the amount was small, and, worse still, very variable, depending largely upon the working of the blast-furnace. As the result of a number of experiments initiated by Mr. K. M. Chance, of the British Potash Co., Ltd., it was discovered that by adding a small proportion of salt to the blast-furnace charge, practically all the potash present could be volatilised as chloride and recovered in the flue-dust. Messrs. Rossiter and Dingley investigated for the above company the percentages of potash in a large number of iron-ores, and published their results in November, 1919, in the Journal of the Society of Chemical Industry. The ores richest in potash are the bedded ironstones of Secondary age, such as those of Northamptonshire, Cleveland, Lincolnshire and Oxfordshire, which showed respectively 0·42 per cent., 0·36 per cent., 0·36 per cent. and 0·30 per cent. of potash. When salt is added to the charge of a blast-furnace smelting these ores, flue-dusts are obtained that contain about 30 or 35 per cent. of K_2O as chloride or other water-soluble salts. Such dust is, therefore, considerably richer in potash than the ordinary manurial salts hitherto supplied from Germany, and it seems probable that it could be applied direct to the land with very beneficial results, though not much work has as yet been done in this direction.

The experiment of adding salt to the blast-furnace charge has as yet been tried in only a few works, and the bulk of the dust thus produced appears to have been worked up for potash salts at the works of the British Potash Co., Ltd., at Oldbury. In the paper already referred to, it is calculated that if the salt process were adopted in every blast-furnace in Britain, potash equivalent to 50,000 tons of K_2O could be recovered annually. This figure is about double that of the British consumption of potash for agricultural purposes before the war, but falls far short of the amount that we really require in this country, whilst it need scarcely be said that nothing even remotely approaching it has as yet been produced, nor does there appear to be the slightest prospect of reaching it for many years to come.

In the meantime, British agriculture needs potash and needs it most urgently. Agriculture is the most vital of our industries, and when the process of destroying our coal-mining industry, and with it our manufacturing industries generally, now apparently in full swing, has been consummated, it will be the only means by which the inhabitants of these islands can continue to exist. It would appear, therefore, that the best policy in our national interests is to help our French Allies to develop as speedily as possible the potash resources of their recovered province, and to obtain from them the supplies of potash which our lands, neglected in this respect during the war, so sorely need. Of course, the potash-bearing blast-furnace flue-dust would continue to be worked up, as it is at present, for the manufacture of high-grade salts of potash, and no doubt it would be able to supply a certain proportion of the British consumption of such salts, and to this extent decrease our imports.

Human Palæontology.

Les Hommes Fossiles: Eléments de Paléontologie Humaine. By Prof. Marcellin Boule. Pp. xi+491. (Paris: Masson et Cie, 1921.) 40 francs net.

ON opening the covers of this magisterial work by Prof. Marcellin Boule, one has the feeling of having entered a court of justice where a severe judge has conveyed to counsel and to witnesses that his cases are to be tried according to the strict law of evidence, and that he will stand no nonsense. All the cases on which is based our conception of the antiquity and origin of man come up for review; judgments are duly given in such clear, unmistakable terms that they carry with them an air of finality. For example, there is the case for eoliths—whether they have been fashioned by the hand of man or by Nature;

the judge listens to what Sir E. Ray Lankester and Mr. T. Reid Moir have to say for the worked flints from the Pliocene deposits of East Anglia. A decided verdict is given against them, because, so the judge asserts, it is impossible to tell Nature's handiwork from that of man! For the learned judge that ancient stone culture known to experts as Chellean, which many archæologists regard as marking a high point in man's skill as a worker in flint, is the earliest that can be attributed to human hands. He admits that there must be preceding and more primitive stone cultures, but Prestwich and Harrison, and also M. Rutot who has espoused the cause of eoliths "by the publication of an avalanche of pamphlets," were, and are, gravely in error.

Then the famous Piltdown case comes up; our eminent geologist, Dr. Smith Woodward, finds himself very severely handled by our equally eminent geological judge. Our British colleague is censured, in the first place, for giving the name Eoanthropus—"dawn man"—to the being discovered by Mr. Charles Dawson at Piltdown; this name, in the judge's opinion, should have been reserved for the early pygmy humanoid form which he expects may turn up any day. Here our learned judge leans on the case of the horse's evolution as a precedent, but it would be well for the reader to remember that the evolutionary histories of men and horses are not on "all-fours," or even on "all-twos." In the second place, Dr. Smith Woodward is censured for creating a new genus of mankind by fitting the lower jaw of an extinct chimpanzee to a human skull. Therein our judge follows the lead of Prof. Waterston and of Dr. Gerrit Miller. The latter has even given a name to the owner of the Piltdown mandible—*Pan vetus*. Prof. Boule does not like the American way of naming chimpanzees, and so has rechristened the supposed real owner of the mandible, *Troglodytes Dawsoni*! Nor are these all the points in the Piltdown verdict; Dr. Smith Woodward, it seems, in spite of his ultra-caution, is also in error as to the date at which this chimpanzee-man was, or chimpanzee and man were, alive on our Sussex weald. Dr. Smith Woodward, erring on the side of safety, placed them just before, or at the dawn of, the Chellean culture period; the verdict now delivered is that Dawson's man and Dawson's chimpanzee are later—towards the close of the immense span of time covered by the Chellean period. England had a different configuration then, but all are agreed that at the close of the Chellean, or early in the Acheulean, period our climate was much what it now is. Under such climatic conditions one can understand how Dr. Smith Woodward's Eoanthropus eked out a livelihood; but how a chimpanzee succeeded in this feat neither Prof. Boule nor Dr. Gerrit Miller has given us any enlightenment.

An equally erratic judgment is passed on the fossil remains discovered by Dubois in Java. Pithecanthropus is declared to be a giant gibbon moving towards the human stem. Verdicts such as these need not be taken so seriously as they are delivered. Even expert geologists, anatomists, and archæologists will have some sense of the humorous situation we have reached in human palæontology. For the benefit of those who keep an anti-Darwinian eye on what is passing in our anthropological courts, it may be well to explain that Prof. Boule is a convinced believer in the truth of evolution, is certain that man has descended from a simian form, and is confident that we shall find his ancestry in Miocene or earlier deposits. He admits, too, that modern man is more closely related to anthropoid apes than these are to Old World monkeys. The dispute turns on the particular route by which man has travelled to his present estate. The only evidence which will serve as guide has to be gleaned by a long and arduous study of the anatomy of Primates, and, with all due deference to our eminent French colleague and to Dr. Gerrit Miller, it is the opinion of the reviewer that neither the one nor the other has shown competence in this respect.

It is true that Prof. Boule denounces as utterly untrustworthy the Cuvierian axiom—namely, that any animal form may be reconstructed from a single bone; and yet when he comes to the mandible found at Piltdown—a bone showing exactly the same degree of fossilisation as an adjacent skull, of a size to fit the skull, with a texture and structure of bone in keeping with the skull, but with certain features in the mandible itself and in the teeth which are to be seen in the lower jaws of chimpanzees, and also other features which are not—he promptly forgets all about the falsity of Cuvier's axiom, and creates a new species of chimpanzee to get rid of the difficulties with which the Piltdown discovery has confronted him. He forgets, too, that on an adjoining page, when giving his verdict on the Heidelberg mandible, he states that, had he found the jaw without the teeth, he would have assigned it to an ape, but that, had he come across the teeth without the jaw, he would have supposed them to be human. If only the frontal bone of Neanderthal man were known, it would undoubtedly be assigned to a gorilla with a big brain, because it is provided with a great gorilla-like supraorbital ridge. The time has come which Darwin foresaw must come. He anticipated that, as our discoveries approach the point of human departure from a simian stock, doubts must arise as to whether we are dealing with ape-like men or man-like anthropoids, so great must be their mixture of simian and human features. This is the point we have reached in Pithecanthropus and in Eoanthropus, and Prof. Boule has bungled the diagnosis in each case.

Much as we regret to differ from our distinguished French colleague, we own to an open liking for his frank verdicts and to a fellow-sympathy for some of his human failings. He passes the most severe censure on those who venture to reckon the length of geological periods in years, but presently we find that he himself is a fellow-sinner, and gives 125,000 years as a round figure for his Pleistocene period—which begins with the extinction of *Elephas meridionalis*—and that about 10,000 years have elapsed since the Ice age ended. Then, again, he will have nothing to do with genealogical trees of man's descent; but anon we find him guessing just as hard as any of us. He admits that the tree that can be most easily "defended" is one which brings man's phylum off from the root-stock of the anthropoid apes; but all the same he is inclined to go rather deeper for a beginning—to the stock from which anthropoids and Old World monkeys arose—the Darwinian point of departure. Then, again, he expresses the utmost surprise that such a distinguished man of science as Prof. H. Fairfield Osborn should countenance the reconstruction of fossil forms of man. On an adjoining page we find quite a daring reconstruction of the face of Neanderthal man, with all the facial muscles dissected out in the most workmanlike manner. In short, we tender the author of this work our sincere homage; we commend it as a very clear and complete compendium of the evidence relating to man's antiquity and origin—with the proviso that the reader must use his own judgment as to the true bearing which the facts here presented have on the problem of man's evolution.

Arthur Keith.

British Scientific Instruments.

Dictionary of British Scientific Instruments. Issued by the British Optical Instrument Manufacturers' Association. Pp. xii+335. (London: Constable and Co., Ltd., 1921.) 21*s*.

THE British Optical Instrument Manufacturers' Association, which is one of the industrial associations working in connection with the Department of Scientific and Industrial Research, has just issued this very useful dictionary. The main part of the work consists of a list of British instruments arranged alphabetically, with a brief description of each and an indication as to the firm or firms which supply it. Illustrations of a large number of the more important instruments are also included. Some of these are shown in position at the National Physical Laboratory. The utility of the book is obvious; it serves as a dictionary to the inquirer who wishes to know something about an instrument which he hears mentioned in conversation or reads of in a book; it is also a trade handbook, giving the would-be purchaser at a glance information as to where an instrument he desires to acquire can be obtained. This, however, is not all; the volume illustrates in a remarkable way the activities of the trade, the range of instruments of British manufacture, and the debt men of science owe to the instrument maker. The work has been well carried out, the list is very complete, and cross-references are numerous; the definitions or explanations are clear and concise. Thus:—

"*Galvanometer.*—An instrument for measuring electric currents usually by the deflexion of a magnetic needle in the magnetic field created by an electric current, or by the deflexion of a moving coil, carrying the current, in the field of a fixed magnet. There are thus two main types: the moving magnet and the moving coil galvanometer."

Or again:—

"*Hydrometer.*—An instrument for determining the specific gravity of liquids. Attributed to Archimedes, but not much used until it was re-invented by Robert Boyle. It usually takes the form of a narrow sealed instrument of cylindrical section, and consists of three parts—the counterpoise at the bottom; the bulb containing air; and the stem with the scale at the top. Made of glass or gilt brass. In the latter case the hydrometer is usually provided with weights which are slipped over the stem and alter the buoyancy of the instrument so as to adapt it to liquids of various specific gravities."

Useful illustrations of various patterns of galvanometer are given; it is a mistake, however, to spell Sir Wm. Thomson's name with a "p," and the astatic mirror galvanometer figured is one of his.

But there is more in the book than this dictionary. Meteorology, navigation, and astronomy have long been subjects of investigation, and many of the instruments described have been devised in order to facilitate the study of the weather and the stars, or to assist the navigator on the trackless waters. Hence there have been included very